CLAIMS:

What is claimed is:

1. A method of extracting information about a system of nuclear spins from a region of an earth formation comprising:

Performing a plurality of nuclear magnetic resonance measurements on the system of nuclear spins;

Acquiring nuclear magnetic resonance data from each of the plurality of nuclear magnetic resonance measurements;

Computing a multi-dimensional dataset from an inversion process performed on the nuclear magnetic resonance data that is independent of prior knowledge of the region.

2. The method of claim1, further comprising the step of:

Generating a multi-dimensional graph of the multi-dimensional dataset.

3. The method of claim 2, wherein the multi-dimensional graph is expressed along a set of axes selected from the group of diffusion, T1, T2 and a ratio of T1 and T2.

4. The method of claim1, further comprising the step of:

Compressing the nuclear magnetic resonance data prior to computing the multi-dimensional dataset.

5. The method of claim 4, wherein compressing the nuclear magnetic data comprises transforming the data using a singular value decomposition.

6. The method of claim1, the computing step further comprising the step of:

Evaluating a plurality of functions, $M_n(x_i)$, whose expectation values define the moments, $\underline{\overline{M}_n = \sum_i M_n(x_i) f(x_i)}$ where $f(x_i)$ is the object distribution function, which is also expressed in terms of the same functions $\underline{f(x_i) = Z^{-1} \exp\left(\sum_n \alpha_n M_n(x_i)\right)}$,

where α_n are parameters which are adjusted such that the moments computed using $\overline{M}_n$ and $f(x_i)$ agree with the nuclear magnetic resonance data.

7. The method of claim 6, the evaluation step further comprising the steps of:

Comparing the computed moments $\overline{M}_n$ with a set of data moments obtained from the nuclear magnetic resonance values;

Determine a fit quality between the computed moments $\overline{M}_n$ and the set of data moments;

Determine a final distribution when the fit quality is within a tolerance limit.

8. The method of claim 7, the evaluation step further includes the step of:

Adjusting α_n to improve the fit quality.

9. The method of claim 6, wherein the computation step provides a distribution which is simultaneously consistent with all the available data and has the maximum entropy, S, as given by $S = -k\sum_i \ln(f(x_i))f(x_i)$, where k is a constant.

10. The method of claim 6, wherein a number of N significant moments functions is determined based on the plurality of moments, $\overline{M}_n$, having a value above a noise level associated with the nuclear magnetic resonance data.

11. The method of claim 10, wherein the number of parameters, α_n, used to fit the data should not exceed the number of the moment functions N.

12. The method of claim 6, wherein each moment within the computed moments $\overline{M}_n$ is independent of each other computed moment.

13. The method of claim1, wherein the inversion process is independent of a regularization parameter.

14. The method of claim 1, wherein the inversion process is independent of a specific measurement sequence.

15. A logging apparatus comprising:

A logging tool that is movable through a borehole; and

A processor coupled to the logging tool, the processor being programmed with instructions which, when executed by the processor, perform the steps of:

Perform a plurality of nuclear magnetic resonance measurements on the system of nuclear spins;

Acquire nuclear magnetic resonance data from each of the plurality of nuclear magnetic resonance measurements;

Compute a multi-dimensional dataset from an inversion process performed on the nuclear magnetic resonance data that is independent of prior knowledge of the region.

16. The logging apparatus of claim 15, the processor further performing the step of:

Generating a multi-dimensional graph of the multi-dimensional dataset.

17. The logging apparatus of claim 16, wherein the multi-dimensional graph is expressed along a set of axes selected from the group of diffusion, T1, T2 and a ratio of T1 and T2.

18. The logging apparatus of claim 15, the processor further performing the step of:

Compressing the nuclear magnetic resonance data prior to computing the multi-dimensional dataset.

19. The logging apparatus of claim 18, wherein compressing the nuclear magnetic data comprises transforming the data using a singular value decomposition.

20. The logging apparatus of claim 15, the computing step further comprises the step of:

Evaluating a plurality of functions, $M_n(x_i)$, whose expectation values define the moments, $\overline{M}_n = \sum_i M_n(x_i) f(x_i)$ where $f(x_i)$ is the object distribution function,

which is also expressed in terms of the same functions $f(x_i) = Z^{-1} exp\left(\sum_n \alpha_n M_n(x_i)\right)$, where α_n are parameters which are adjusted such that the moments computed using $\overline{M}_n$ and $f(x_i)$ agree with the nuclear magnetic resonance data.

21. The logging apparatus of claim 20, the evaluation step further comprises the steps of:

Comparing the computed moments $\overline{M}_n$ with a set of data moments obtained from the nuclear magnetic resonance values;

Determine a fit quality between the computed moments $\overline{M}_n$ and the set of data moments;

Determine a final distribution when the fit quality is within a tolerance limit.

22. The logging apparatus of claim 21, the evaluation step further includes the step of:

Adjusting α_n to improve the fit quality.

23. The logging apparatus of claim 20, wherein the computation step provides a distribution which is simultaneously consistent with all the available data and has the maximum entropy, S, as given by $S = -k\sum_i ln(f(x_i))f(x_i)$, where k is a constant.

24. The logging apparatus of claim 20, wherein a number of N significant moments functions is determined based on the plurality of moments, $\overline{M}_n$, having a value above a noise level associated with the nuclear magnetic resonance data.

25. The logging apparatus of claim 24, wherein the number of parameters, α_n, used to fit the data should not exceed the number of the moment functions N.

26. The logging apparatus of claim 20, wherein each moment within the computed moments $\overline{M}_n$ is independent of each other computed moment.

27. The logging apparatus of claim 15, wherein the inversion process is independent of a regularization parameter.

28. The logging apparatus of claim 15, wherein the inversion process is independent of a specific measurement sequence.